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ABSTRACT

A study examined how global coherence in story comprehension develops in children through causal inference. Stories of contrasting structure were analyzed by a causal network model. Evidence of parallels between the construction of coherent representations and the development of the story understanding is presented. Data show that children understand the role of goals in motivating actions locally within an episode by the age of 5, and integration within episodes is well established by age 8. However, from 8 to 11 years, changes in the understanding of how states and actions are related across episodes become more marked. By age 14, story structures become more important. This finding indicates that development of story understanding follows a sequence in which integration via inferences of information within episodes precedes that between episodes, and that both forms of integration change with development. The causal network model builds story structure in a parallel fashion. Together, these findings suggest that global coherence in story representation follows from local understanding of relations between states and actions. A list of 21 references is included. (Author/MSE)

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The Development of Coherence in Narratives by the Understanding of Intentional Action

by

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Abstract

On analytic and developmental grounds, global coherence in story comprehension may develop out of local understanding of states and actions organized around goals. The construction of a coherent representation of a story follows from inferring relations between states and actions, integrating these events into episodes, integrating episodes by relating their actions or states, and organizing episodes into higher-order structures.

To demonstrate how a coherent narrative structure arises out of local causal inferences based on knowledge of intentional action, stories of contrasting structure are analyzed by a causal network model. Evidence for parallels between the construction of coherent representations and the development of the story understanding is presented. Data from judgments of the importance of statements (van den Broek, in press; 1985) and from answering questions by children (Liu, 1988) show that children understand the role of goals in motivating actions locally within an episode by the age of 5 years. The integration within-episodes is well established by age 8. However, from 8 through 11 years, changes in understanding how states and actions are related across episodes become more marked. This kind of integration requires understanding of how failed outcomes cause new goals to be generated and how successful actions and outcomes enable other actions in different episodes. By age 14, between episode integration and the importance of the role of topical statements in organizing episodes into higher-order, story structures both become more apparent.

The data indicate that development of story understanding follows a sequence in which integration via inferences of information within episodes precedes that between episodes, and that both forms of integration change with development. The causal network model builds story structure in a parallel fashion. Together, they suggest that global coherence in story representation follows from local understanding of relations between states and actions.

Introduction

This paper discusses how one might construct a coherent interpretation of a narrative by application of local inferences from one's knowledge of intentional action. To do this, a causal network model for discourse analysis (Trabasso, van den Broek and Suh, in press) is outlined and is used to describe how one constructs representations of stories that differ greatly in structure and in meaning of content. The constructive process, based upon the analytical model, is then shown to find support in developmental data of children who judge the importance of, or answer questions on story statements that they read or heard. The analysis and data indicate that story understanding and its development procede in parallel manner, from simple to complex integration of the content by causal inferences that result from the application of the development of common knowledge of intentional action.

The development of coherence in storytelling.

When children tell stories, they do so in a systematic, developmental manner (Stein, 1986; Stein and Policastro, 1984). Children's early stories are composed mostly of unrelated, descriptive states. Later, they describe actions that are only temporally related. Still later, they begin to relate actions by causal and temporal inferences. Later still, they eplicitly include goals and purposes that direct the actions in more complete episodes. Finally, they produce story themes in which the protaganist's goals are blocked or come into conflict with those of others. In these stories, subgoals are often generated and embedded. These result in the formation of complex and hierarchical episodic structures.

The development of the ability to generate and to understand narrative discourse depends upon growth in knowledge of intentional action, and growth in application of this knowledge to everyday events as well as to narratives. The application entails knowledge about (1) the kinds of problems that animate beings frequently encounter and attempt to solve, (2) the goals and plans that result from such problems, (3) the actions that may be carried out as attempts to attain the goals, (4) the consequences or outcomes of pursuing a

given course of action, and (5) the internal states other than goals such as thoughts, beliefs, emotions and feelings as well as involuntary actions that accompany problems, failures and solutions.

In the corpus of children's stories studied by Stein (1986), as the narratives develop from simple to complex episodes, they become increasingly coherent. The stories form more than a list or series of descriptive states or temporally successive actions. They form causally connected, integrated wholes that correspond to adult defintions of well-formed stories (Stein and Policastro, 1984). The central question of this paper is: How is this development of coherence achieved, not only by children but also in the interpretation of a story itself?

In answer, global coherence is achieved by making local, causal inferences between states and actions. This application of knowledge of intentional action to a story's content is assumed to arise from a common knowledge base that develops in a manner parallel to the construction of the representation of a given story. Local coherence results from understanding how goals and other internal states arise from undesired changes of state produced by events, how goals lead to plans that direct actions toward changing the undesired state of affairs, and how goal-directed actions result in changes of state that either satisfy or fail to achieve the goals. Thus individual events occur and activate general knowledge of intentional action. This knowledge is then used to interpret the events and their implications. As a result, expectations are established that guide interpretation of subsequent events and the making of inferences that inter-relate them. The content of the events constrain what is activated, what is expected and what types of relations are inferred between states and actions. Together, these activities form a continously changing set of circumstances that constrain the generation and interpretation of subsequent states and actions and contribute to the subjective feeling of coherence. Since knowledge of intentional action develops and is limited, what develops and how it is applied determine and reflect the constructive process. We now turn to how one might describe this process

analytically. We then present data from developmental studies that are consistent with this analysis.

Insert Table 1 about here

The construction of coherent understanding.

How coherence is built from local constraints is now illustrated with an analytic model for discourse representation by Trabasso, van den Broek and Suh (in press). Suppose that you were reading a story such as that depicted in Table 1 about a boy named Jimmy (taken from van den Broek, 1988). When you read the setting statement (S1) that there once was a boy named Jimmy, you begin to infer a set of circumstances concerning a boy by the name of Jimmy in some place and time. These circumstances constrain and enable the states and actions that follow and can serve as a topic for the organization of a series of episodes. The initiating event (IE1) of Jimmy's seeing Tom's new 10-speed bike sets up expectations that he is going to react to it in some way so that when you experience the goal statement (G1) that he wants such a bike, you are not surprised given the circumstances and knowledge about boys and bikes. The goal is very important since it directs actions that are carried out in attempts to achieve it. As such, this analysis of understanding amounts to application of naive theories of intentional action. Jimmy's action (A1) of counting money is best understood as an attempt to find out if he could buy a bike. An expectation is set up but is uncertain as to outcome with respect to goal attainment. The story informs you that Jimmy does not, in fact, have enough money--a failed outcome (FO1). At this point, you have integrated or organized via inferences five states and actions into a structure called an episode.

My colleagues and I (van den Broek, in press; Trabasso and van den Broek, 1985; Trabasso, van den Broek and Liu, 1988; Trabasso, van den Broek and Suh, in press) have evolved a general transition network model for narrative analysis and representation in which the basic unit is an episode composed of causally connected categories. In the

model, Settings (S) provide the circumstances or conditions that enable the states and actions to occur. Initiating Events (IE) begin the story with a change in state that psychologically causes the protagonist to react (R) emotionally or cognitively and to set up a goal (G) to alter the state change. The goal (G) motivates other goals or actions (A). Actions (A) enable other actions; they also enable or physically cause outcomes (O) that either attain or fail to attain goals. The outcomes (O), as goal failure or success, psychologically cause reactions (R) or goals (G). They may also enable or physically cause other outcomes (O). Each of the events are recursive and may lead to categories of the same kind, i. e. cognitions such as thoughts or beliefs can determine other thoughts or beliefs, etc.

The preceding discussion of the Jimmy story was done in terms of this model and indicates how one can integrate a series of states and actions into an episodic unit. Thus, in the Jimmy story, the five states and actions are not seen as a list or even as a simple chain of events. Rather, they are seen as an integrated series of states and actions that have coherence. Integration between episodes is made by inferences between states and actions but the constituents now belong to different goal structures. When this kind of inferencing occurs, it leads to a coherence that is more global in nature. Underlying the inferences that causally relate the states and actions is an assumption that each causal state or action is necessary in the circumstances of the story for its consequent state or action (Mackie, 1980). That is, if the cause A had not occured, then the consequent B would not have occurred in the circumstances of the narrative. In the discourse analysis of a wide range of stories, this counterfactual criterion has served to aid in the identification of causal inferences that reliably structure the story and provide a basis for predicting memory, judgment of importance, summarizing, and answering questions on the narrative events (van den Broek, 1988; in press; van den Broek and Trabasso, 1986; Trabasso, Secco and van den Broek, 1984; Trabasso and van den Broek, 1985; Trabasso and Sperry, 1985; Trabasso, van den Broek and Liu, 1988; Trabasso, van den Broek and Suh, in press).

In the model, the categorical nature of the content in the episode and the causal chaining between the categorized content can be generalized by allowing the categories to be recursive. By this process, one can constrain relations between states, actions and state changes and generate or describe a large variety of story structures.

Insert Figure 1 about here

Figure 1 (after van den Broek, 1988) shows two specific realizations of the model that contrast markedly in both structure and meaning but not in content. In the first, the episodes follow one another sequentially; in the second representation, the episodes are embedded by failed goals and outcomes or are enabled by successful attainment of goals. The upper figure depicts a hierarchically structured story in which the episodes are embedded; the lower figure depicts a sequentially structured story in which the episodes follow one another in succession.

The hierarchical story structure in Figure 1 is that derived by applying the general transition network model of Trabasso, van den Broek and Suh (in press) to the story in Table 1. The story and its representation consist of three episodes that describe (1) how Jimmy buys a bike, (2) how he earns money, and (3) how he obtains a job. The numbers in the left column of Table 1 identify the three episodes. The episodes of the Jimmy story in Table 1 form a hierarchical story because the second episode of earning money is subordinate to the first episode of obtaining a bike, and the third episode of getting a job is subordinate to the second episode. The statement categories are named in the second and notated in the third columns of Table 1. An asterisk marks the second occurrence of a statement category within a given episode.

As can be seen in Figure 1, causal relations can occur within and between episodes. That is, within an episode a goal motivates an attempt, an attempt enables an outcome, and an outcome contains an attempt that is motivated by a goal. That is, in episode three, Jimmy lands a job. The episode begins with a goal: Jimmy wants a paper route (G3). The goal

motivates an attempt: Jimmy goes to the newspaper office (A3). The attempt enables an attempt in a successful outcome:: Jimmy accepts a paper route (SO3). This attempt in the outcome is also motivated by the goal of wanting a job (G3).

Causal relations between episodes result when a statement or statements in one episode psychologically causes, motivates or enables a statement or statements in another episode. Between episode relations are those between failed outcomes and goals, or between goals, successful outcomes and actions. For example, in the first episode, Jimmy wants to buy a bike (G1). This motivates him to count his money (A1). Counting his money enables him to find out that he does not have enough money, a failed outcome (F01). Finally, the goal of wanting a bike (G1) motivates and the failed outcome of not having enough money (FO1) conjoin to cause psychologically the subgoal of wanting to earn money (G2). The subgoal of wanting to earn money starts the second episode. In Table 1, one can also infer that the successful outcome of the third episode (SO3), Jimmy's obtainment of a job as a paperboy, enables an attempt in the second episode (A2*), the delivering of newspapers. This action is also motivazted by Jimmy's goal of earning $100 (G2). The goal (G2), the attempt (A2*) and the subordinate successful outcome (SO3) jointly are necessary and sufficient for the successful outcome (SO2) of earning the $100. Thus, successful outcomes may be causally antecedent to superordinate actions and outcomes.

A sequential version of the Jimmy story is given in Table 2. Its

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Insert Table 2 about here

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structure is shown in the lower half of Figure 1. Note that the sequential story in Table 2 contains the same states and events as those in the hierarchical story in Table 1. The contrast between the two stories is structural and in meaning: In the sequential story, Jimmy wants a job and gets one, he wants to earn $100 and uses his job to do so, and he wants a bike and buys one with his $100. Although the content is the same in the two

versions, the reasons why he wants a job, why he earns $100 and why he buys a bike are radically different. In the hierarchical version, the reasons or causes are based upon a hierarchy of goals; in the sequential version, the reasons for the goals are not as clearly specified. As a result, the hierarchical version permits a greater number of inter-episodic inferences than does the sequential version. In the hierarchical version, subordinate goals are caused by superordinate goals and failures to obtain them. Superordinate successful outcomes are enabled by the attainment of subordinate goals. In the sequential version, there are no relations between the goals and between the goals and failed outcomes. There are, however, similar enabling relations between successful outcomes and actions. Thus, the sequential version serves as a control for the hierarchical, inter-episodic relations on goals and failed outcomes.

Importance judgments and integration of states and actions

Trabasso & Sperry (1985; see also Trabasso & van den Broek, 1985) examined the basis for the making of judgments of importance of individual states and actions in narratives. The stories were taken from collections of Japanese and Chinese folktales (Sakade, 1957) and the importance judgments were obtained by Brown and Smiley (1977) on adult judges. Trabasso and Sperry analyzed each of these stories as a causal network and found the number of direct causal inferences (including both antecedents and consequents) for each state and action. They then found a strong, linear relationship between the degree of importance of a state or action and its number of direct causal relations. This finding indicates that when people judge the importance of a state or action in relation to the text as a whole, they apprehend the degree to which that state or action is directly related causally to other states or actions. If one then assumes that the making of causal relations integrates states and actions into a representation of the narrative, then one can use the importance judgment as an index of the amount and kind of integration that occurs. That is, if the goal state varies in the number of connections that it has to actions within an episode, then judgments in importance of goals would index the ability to

integrate information into episodes. On the other hand, if goals and outcomes cause goals between episodes, then judgments of importance should index the amount of integration between episodes.

Within episodic integration.

In a doctoral thesis carried out under the author's direction, Paul van den Broek (in press; 1985; 1988) had 756 students from four age groups rate the importance of each state and action in two hierarchical or two sequential stories. The average age (and number of students) in the respective groups was 8 years 9 months (n = 193), 11 years 7 months (n = 205), 14 years 9 months (n = 179), and 18 years 2 months (n =180). van den Broek found that all the students were sensitive to the number of actions that were directly motivated by goals. The goals had either 4, 8 or 12 direct connections to actions within an episode. The corresponding average judgments of importance were: 3.35, 3.74 and 4.2, a strong, linear relationship. On the basis of this finding, one would conclude that at least by age 8, children can use intentional knowledge about goals to infer the reasons for actions. Since goal-action inferences integrate goals, actions and outcomes into episodes, we conclude that episodic integration is well along in understanding of stories by the age of 8 years.

The value of 8 years probably underestimates the ability and overestimates the age at which children can make inferences that integrate information within episodes. Goldman (1985), Goldman and Varnhagen (1986), Stein (1986), and Stein and Glenn (1979) have evidence from causal questioning after children hear stories that children as young as five years in age can make both within- and between-episode causal inferences on actions and on goals. Data from our laboratory (Liu, 1988) on questioning during the hearing of a story by 5- and 8-year old children are consistent with these findings and are presented below. The present point is not one of competence but the relative degree and order in which within- and between-episode inferences occur as indexed by importance judgments over the age groups that are studied. Thus, for our purposes, within-episode integration is well established and occurs to the same degree across all age groups in the van den Broek study.

However, it is the between-episode relations that show the most striking developmental differences. Developmentally, therefore, within-episode integration appears to develop more fully before between-episode integration.

Between-episode integration.

Goals, actions and outcomes. Goals and outcomes inter-relate episodes in the two story structures whereas actions have only intra-episode relations. Let us suppose that as children become more knowledgable, they are able to make more inferences that not only serve to integrate goals and actions within episodes but begin to relate episodes themselves. If so, since goals and outcomes allow more inferences to be made than do the actions in the stories, children should, as they become older, make more of these inferences and differentiate goals and outcomes from actions by rating them as more important.

This was, in fact, the case in van den Broek's (in press, 1985) study. The average differences in importance ratings for states that inter-relate episodes (goals and successful outcomes) and actions that relate actions and states within episodes for the four respective age groups were .22, .32, .36 and .65. Note that although there is evidence for between-episodic integration in all four age groups, the initial difference appears at age 11 and the largest difference occurs in the 18-year old group.

Failed and successful outcomes. Comparing the importance judgments across the hiearchical and sequential stories for failed-outcomes tells us whether or not the children made inter-episodic inferences and used them as a basis for their judgments. The hierarchical stories, it will be recalled, allowed such inferences for failed outcomes whereas the sequential versions did not. The data on failed outcomes parallels exactly those in the previous section on goals and successful outcomes versus actions. The average difference in importance judgment ratings between the hiearchial and the sequential versions increased with age. The mean differences in importance for the respective four age groups were: .11, .52, .50 and .83. Again, although the 8-year olds showed evidence for between-episode

integration in their judgments, the increase is more noticeable by ages 11 and 14, and was markedly increased by age 18.

While failed outcomes varied in their numbers of causal connections in the two structures, successful outcomes had identical numbers and kinds of connections in the two story versions. Hence, no differences should occur with age in importance judgments on successful outcomes as a function of the structure of the story. This was, in fact, the case. The mean differences in importance judgments were negligible across the respective four age groups: .01, .10, -.05 and .03.

Settings. Setting statements such as those that introduce the character provide important background information or conditions for the action of a narrative. In addition, a setting that introduces the protagonist may take on additional importance in that it serves as a topic of organization of the narrative. In van den Broek's study, the sequential story consists of three episodes that are related by temporal and enabling relations. These relations are weak in comparison to the causal ones that embed the episodes in the hierarchical story versions. In the hierarchical stories, the initiating event of Jimmy seeing Tom's bike begins a long chain of events that finally leads to a purchase of the bike. In the sequential stories, one could organize the episodes around the topic of three events in the life of Jimmy. Thus, the setting statements in the sequential story provide a better basis for a higher order, between-episode integration than they do in the hierarchical story where they merely introduce the main protagonist.

van den Broek's data on the differences in the importance rating for the setting statements between the two versions show that this kind of higher order integration increased with age and that the most noticeable difference occurs at age 14. The average differences in importance ratings for the hierarchial and sequential versions were .14, .09, .97 and .96 for the four respective age groups. Thus, topical integration of episodes, a more global form of coherence, is a later achievement than the more local, between-episode integration due to goals and outcomes. If one assumes that integration of the

information within episodes is necessary to the formation of episodes, and that topical organization occurs after relations between episodes, then topical organization of episodes is a later development, not only in age but also in processing.

These data on goal connectivity (within-episode integration) and on goals, actions and outcomes or failed outcomes or settings (between-episode and higher order integration) indicate that global coherence follows a developmental time course. By the age of 8 years, the children show strong evidence of integration of actions and outcomes by inferences based upon goals. By this age, they also show some evidence of integration of goals and outcomes betweeen episodes but the increase is more noticeable by ages 11 and 14, and is most marked by age 18. Integration of episodes topically by relations to the setting information appears most cleary in ages 14 through18.

These data, then, show a parallel between levels of integration within-and between-episodes and development. The integration, however, is made possible by developing knowledge of intentional action and the application of this knowledge in story understanding. Local inferences that relate goals, actions and outcomes are the building blocks of higher-order structure. Global coherence is achieved out of such local understanding. The development of knowledge of intentional action allows the child to construct representations of stories of increasing complexity and global coherence.

Assessing integration within and between episodes by questions.

The evidence thus far has been indirect. Importance judgments are determined by the number of direct causal connections that exist between states and actions. However, they require both the making of these inferences and the taking of them into account relative to those of other states and actions. A more direct way is to ask specific causal questions about why or how these actions and states occur. As indicated above, several investigators, notably Goldman and Varnhagen (1986), and Stein and Glenn (1979) have questioned children after they heard and/or recalled stories in order to assess comprehension. Further, Graesser and his colleagues (Graesser, 1981; Graesser, Robertson and Anderson, 1981;

Graesser and Clark, 1986) have used questioning primarily to measure which inferences to include in their story representations. The present analytic model is based upon an analysis of the inferences between the surface states and actions of the story and indexes the inferences by arcs and not by content. The model points to the inferences that could be made, not those that are actually made.

Trabasso, van den Broek, and Liu (1988) provide a systematic procedure for assessing and promoting causal inferences by questioning either during or following the listening to or the reading of a narrative. Essentially, their method is to first apply the causal network model to the narrative. Once one has a causal network representation of the text, one can be sytematic about which nodes to query and which questions to use. Suppose, for example, one wishes to ask causal questions about the hierarchical version of the Jimmy story in Table 1. Following the temporal-causal sequence of the story, one can ask: Why did Jimmy want to buy a bike (G1)? Why did Jimmy count the money (A1)? and What did Jimmy do so that he found out that there was not enough money to buy a bike (FO1)? Note that these questions ask for causal and enabling antecedents for goals, actions and outcomes within an episode. A between-episode question would be: Why did Jimmy want to save $100 (G2)? This question focuses on the reasons found in the first episode for a subordinate goal in the second episode. The questioning series of Trabasso et al (1988) continues by cycling through why-questions on goals and actions, and how-questions on outcomes until the end of the story.

Lisa Liu (1988) has carried out a recent dissertation under the author's direction that follows from this analytic approach to narrative representation and causal questioning. Liu asked 5- and 8-year-old children to answer why- questions on goals and actions, and how-questions on outcomes while they listened to hierarchical and sequential stories similar in structure to those depicted in Figure 1 and in Tables 1 and 2. Here, we shall focus only on the data she found on these young children's abilities to answer questions that integrate information within and between episodes.

First, with respect to answers that came from within an episode, the older children showed only a slight advantage over their younger counter-parts on providing causes for goals and actions. The respective mean numbers of answers for the 5- and 8-year groups were .32 and .38. However, the older children were able to provide a much larger number of goals and actions as within-episode answers for how outcomes occurred: 1.31 versus 2.92 average answers per question. Thus, although the 5-year-olds were able to make causal inferences within an episode, they made far fewer than did the 8-year olds. These data are consistent with the findings of Goldman and Varnhagen (1986) and Stein and Glenn (1979).

The data on answers that involve inferences between episodes compare directly with those obtained by van den Broek (1985; in press) on importance judgments. Recall that van den Broek found that the importance judgments increased with age for goals and outcomes relative to actions. Since goals and outcomes begin, end and inter-relate episodes, part of this judgment liesin the making and use of between-episode inferences. Liu's data parallels those of van den Broek. The mean number of between-episode answers for goals, actions and outcomes for the 5-year olds were .33, .11 and .24, showing some ability to provide more reasons for goals and outcomes over actions. These inferences, especially those on goals, increased substantially in the 8-year olds to .96, .34 and .40, respectively.

Comparing how age and development interact with the two kinds of integration, the average number of within-episode answers increased from 1.94 to 3.69, an increase of 90 percent. The average number of between-episode answers increased from .68 to 1.70, an increase of 150 percent. These data then, clearly show that integration of information within episodes is developmentally advanced over integration between episodes but that greater inter-episodic integration occurs with development. Local inferences intially structure episodes and then inter-relate them into higher order structures. This

developmental sequence is reflected in Stein's (1988) analysis of stories that children tell which was discussed in the introduction.

In further support, van den Broek (1988) reports data on question answering that he obtained from his subjects after they had completed their judgments of importance. For goals, he found that the the average proportion of inter-episodic answers per age group was correlated with age. The values were .43, .62, .74 and .75 for the four respective age groups. For successful outcomes, the respective proportions of inter-episodic answers were .42, .51, .53 and .56. These two sets of data show that inter-episodic integration increases with age, and while it is clearly present by age 8, it shows marked changes by age 11. When the inferences required bridging larger units of text, the two older groups do even better.

Since Liu found that questioning the children during listening promoted recall and comprehension of the stories, questioning may overestimate the number of inferences that are made spontaneously by children. On the other hand, the importance judgment task may underestimate the younger child's ability to make these inferences. Despite these problems of competence assessment, the developmental trends in both kinds of measures indicate that higher-order structuring is a developmental outcome and is based upon a developing knowledge of intentional action applied locally to states and actions. Global understanding arises out of local understanding, both in the processing of text and in development.

Footnote

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Table 1

Hierarchical Version of Jimmy Story

Episode	Category, Notation	Content
1	Setting, S1	There once was a boy named Jimmy.
1	Initiating Event, IE1	Jimmy saw Tom's new 10-speed bike.
1	Goal, G1	Jimmy wanted a 10-speed bike.
1	Action, A1	Jimmy counted the money he had with him.
1	Failed Outcome, FO1	Jimmy did not have enough money.
1	Goal, G2	Jimmy wanted to save $100.
2	Action, A2	Jimmy asked his mother for some money.
2	Failed Outcome, FO2	Jimmy's mother said that he should earn his own money.
3	Goal, G3	Jimmy wanted to get a paper route.
3	Action, A3	Jimmy went to a newspaper office.
3	Success Outcome, SO3	Jimmy accepted a paper route.
2	Action, A2*	Jimmy delivered the newspapers before sunrise without missing a house
2	Success Outcome, SO2	Jimmy saved $100.
2	Action, A1*	Jimmy took the money he had saved.
1	Success Outcome, SO1	Jimmy bought a beautiful bike.

Table 2

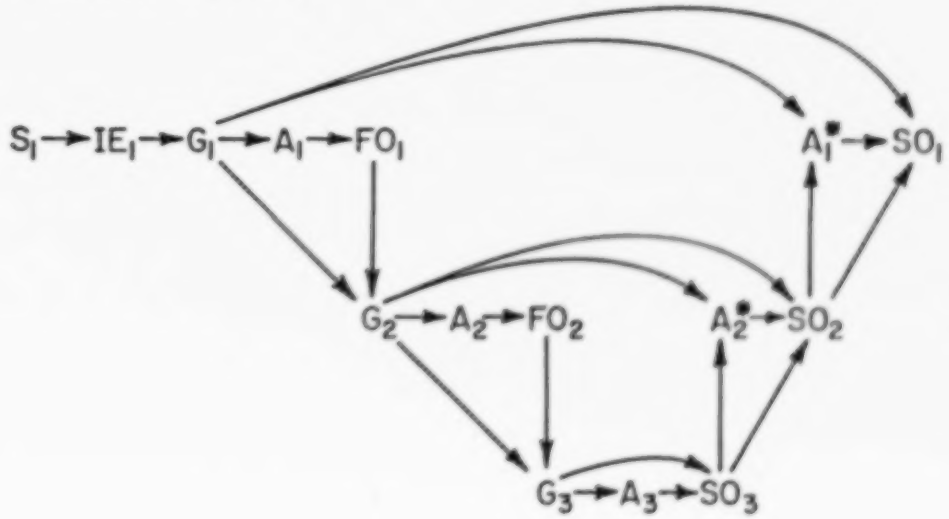
Sequential Version of the Jimmy Story

Episode	Category, Notation	Content
3	Setting, S1.1	There once was a boy named Jimmy.
3	Initiating Event, IE3	Jimmy had a lot of spare time.
3	Goal, G3	Jimmy wanted to get a paper route.
3	Action, A3	Jimmy went to a newspaper office.
3	Success Outcome, SO3	Jimmy accepted a paper route.
2	Initiating Event, IE2	Jimmy did not have enough money.
2	Goal, G2	Jimmy wanted to save $100.
2	Action, A2	Jimmy asked his mother for some money.
2	Failed Outcome, FO2	Jimmy's mother said that he should earn his own money.
2	Action, A2*	Jimmy delivered the newspapers before sunrise without missing a house.
2	Success Outcome, SO2	Jimmy saved $100.
1	Initiating Event, IE1	Jimmy saw Tom's new 10-speed bike.
1	Goal, G1	Jimmy wanted a 10-speed bike.
1	Action, A1	Jimmy counted the money he had with him.
1	Failed Outcome, FO1	The money was not enough to buy the bike.
1	Action, A1*	Jimmy took the money he had saved.
1	Success Outcome, SO1	Jimmy rode his new bike home.

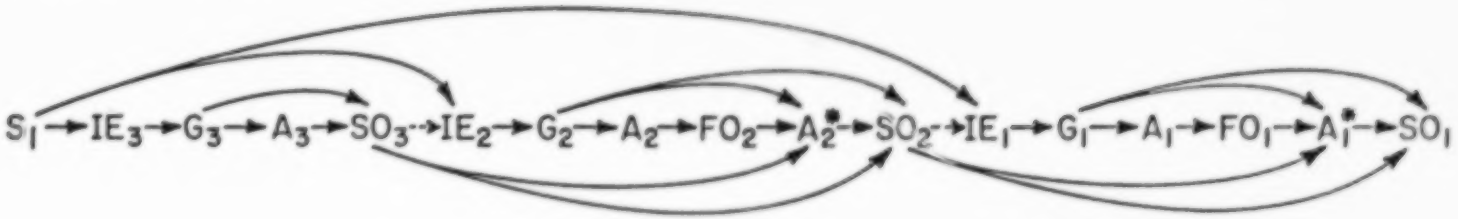
Figure Caption

Figure 1. Causal network representation of the hierarchical and sequential versions of the Jimmy story.

HIERARCHICAL STORY



SEQUENTIAL STORY



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